Warm Up- Use the most appropriate method to:

x value of vertex

y value of vertex

1. State the minimum value and when it occurs given factored form

$A(x) = 5(x-10)(x - 12)$

State zeros: 10 and 12

$AOS = \frac{10+12}{2}$

$x = 11$

Sub $x=11$ to solve y

$A(11) = 5(11-10)(11-12)$

$= -5$

$y=5(x-11)^2-5$

∴ the min value is -5 and it occurs at 11

2. Change to vertex form given standard form

$f(x) = 3x^2 - 12x + 11$

$= 3(x^2-4x)+11$

$=3(x^2-4x+4-4)+11$

$=3[(x-2)^2-4]+11$

$= 3(x-2)^2-1$

Answers

3. Find the zeros given Vertex form

$f(x) = -5(x + 7)^2 + 45$

$0=-5(x+7)^2+45$

$\frac{-45}{-5} = \frac{-5(x+7)^2}{-5}$

$\sqrt{9} = \sqrt{(x+7)^2}$

$\pm 3 = x+7$

$-7 \pm 3 = x$

$x_1=-10$ $x_2=-4$

Think....

- How can you find the zeros when a quadratic cannot be factored?
- You could complete the square then solve for the zeros...
- Let's look at how we could generalize this thought to come up with an easier/faster way. . .

Still don't write.... just think....

Specific Case

$$2x^2+5x+1=0$$
$$2x^2+5x=-1$$
$$x^2+\frac{5x}{2}=-\frac{1}{2}$$
$$x^2+\frac{5}{2}x+\frac{25}{16}=\frac{25}{16}-\frac{1}{2}$$
$$\left(x+\frac{5}{4}\right)^2=\frac{17}{16}$$
$$x+\frac{5}{4}=\frac{\pm\sqrt{17}}{4}$$
$$x=-\frac{5}{4}\pm\frac{\sqrt{17}}{4}$$
$$x=\frac{-5+\sqrt{17}}{4} \quad \text{or} \quad x=\frac{-5-\sqrt{17}}{4}$$

General case

$$ax^2+bx+c=0, \quad a\neq 0$$
$$ax^2+bx=-c$$
$$x^2+\frac{b}{a}x=-\frac{c}{a}$$
$$x^2+\frac{b}{a}x+\frac{b^2}{4a^2}=\frac{b^2}{4a^2}-\frac{c}{a}$$
$$\left(x+\frac{b}{2a}\right)^2=\frac{b^2-4ac}{4a^2}$$
$$x+\frac{b}{2a}=\frac{\pm\sqrt{b^2-4ac}}{2a}$$
$$x=\frac{-b}{2a}\pm\frac{\sqrt{b^2-4ac}}{2a}$$
$$x=\frac{-b+\sqrt{b^2-4ac}}{2a} \quad \text{or}$$
$$x=\frac{-b-\sqrt{b^2-4ac}}{2a}$$

2.11 Solving Quadratic Equations Using the Quadratic Formula

Given the standard form of a quadratic equation:

$$ax^2+bx+c=0$$

we can find the zeros(solutions/roots) of a quadratic equation by the following formula:

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$$

which means:

$$x_1=\frac{-b+\sqrt{b^2-4ac}}{2a} \qquad x_2=\frac{-b-\sqrt{b^2-4ac}}{2a}$$

Solve a Quadratic Equation using a Quadratic Formula

a) $x^2-30x+25=0$ (a, b, c)

$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$

$=\frac{-(-30)\pm\sqrt{(-30)^2-4(1)(25)}}{2(1)}$

$=\frac{30\pm\sqrt{800}}{2}$

$x_1=\frac{30+\sqrt{800}}{2}$ $x_2=\frac{30-\sqrt{800}}{2}$ exact

$x_1 \doteq 29.14$ $x_2 \doteq 0.86$ approx.

b) $2x^2 - 5x = 1$ Rearrange 1st

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$2x^2 - 5x - 1 = 0$
a b c

sol'n $x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(2)(-1)}}{2(2)}$

$= \frac{5 \pm \sqrt{33}}{4}$

$x_1 = \frac{5+\sqrt{33}}{4}$ OR $x_2 = \frac{5-\sqrt{33}}{4}$ exact

$x_1 \doteq 2.69$ $x_2 \doteq -0.19$ approx.

c) $(x-3)(2x+1) = 5(x-2)$ expand & simplify

$2x^2 - 10x + 7 = 0$
a b c

$\frac{10 \pm \sqrt{44}}{4}$

$x_1 = \frac{10+\sqrt{44}}{4}$ $x_2 = \frac{10-\sqrt{44}}{4}$

$x_1 \doteq 4.16$ $x_2 \doteq 0.84$

d) $3x^2 + 2x + 15 = 0$
a b c

$= \frac{-2 \pm \sqrt{-176}}{6}$

Can't √ a negative

(opens up, vertex above x axis)

No solutions

roots or zeros

e) $2x^2 + 7x + 3 = 0$

$x = \frac{-7 \pm \sqrt{25}}{4}$

OR

$x_1 = \frac{-7+\sqrt{25}}{4}$ $x_2 = \frac{-7-\sqrt{25}}{4}$

$x_1 = -\frac{1}{2}$ $x_2 = -3$

f) $9x^2 + 6x + 1 = 0$

sol'n $x = \frac{-6 \pm \sqrt{(6)^2 - 4(9)(1)}}{2(9)}$

$= \frac{-6 \pm \sqrt{0}}{18}$

$= -\frac{6}{18}$ Reduce

$= -\frac{1}{3}$

√0 there is only 1 solution

Also its a perfect square

$(3x+1)^2$

Hmwk

cdf b,e,d

p 222 # 3, 5, 13*, 14* (*thinking)